

Personal Protective  
Equipment (PPE) and  
Respiratory Protection  
for

Pesticides

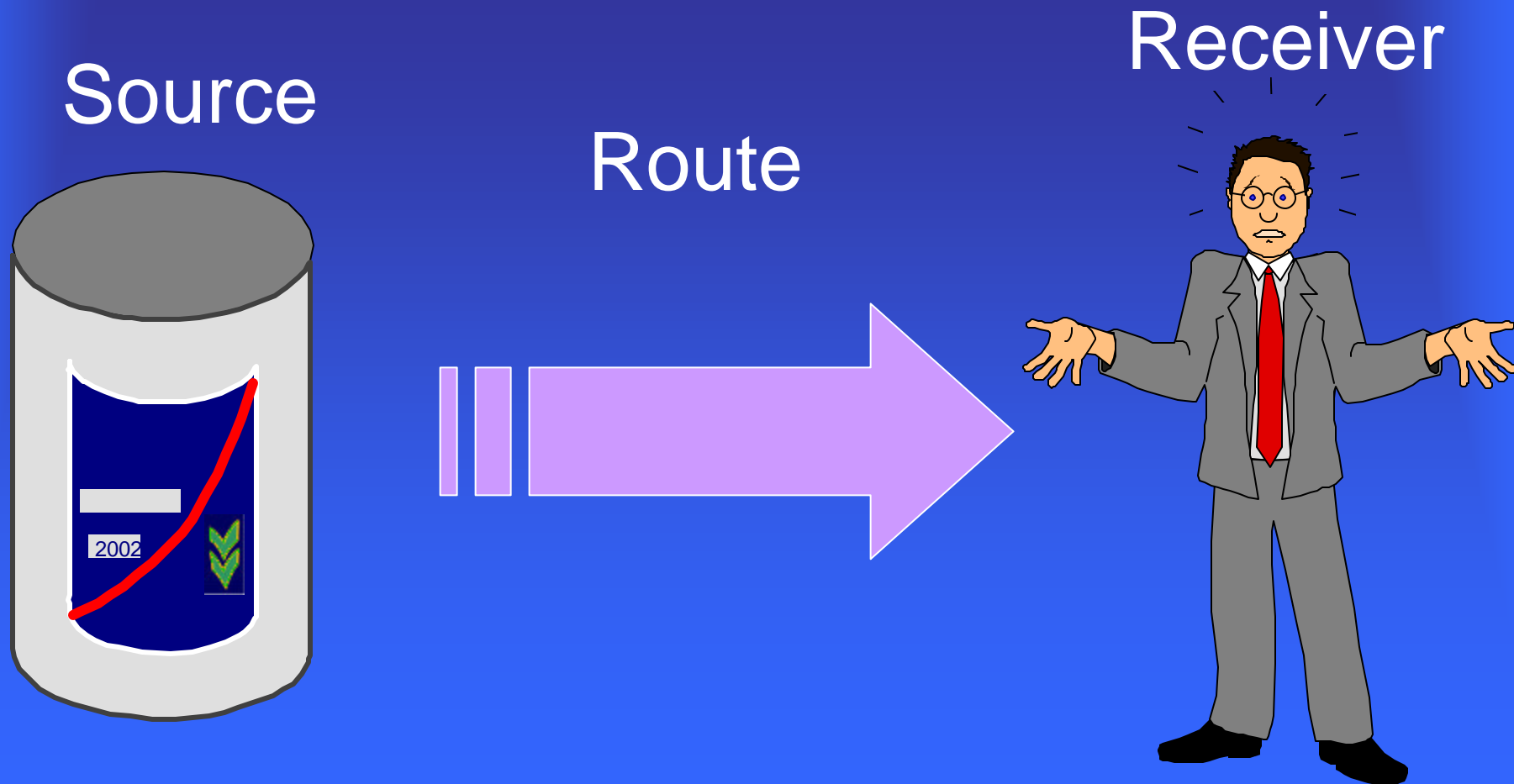
# Homeostasis

The internal environment of human physiology attempts to maintain a narrow range of conditions with respect to temperature, acidity, oxygenation and nutrition.

The exterior environment produces variable conditions over a wide range of temperature, humidity, radiation, pressure, and noxious materials.

# Chemical Hazards

## *Components of Exposure*



# Components of Exposure Sources

Undiluted Pesticide

Application Dilution

Foliar Residue

Off Target Residue

Drift

Degradation Products

# Components of Exposure

## Routes (Ranked)

Injection

Ingestion

Inhalation

**Dermal Absorption**

# Components of Exposure

## **Routes (Pathways)**

Direct Exposure

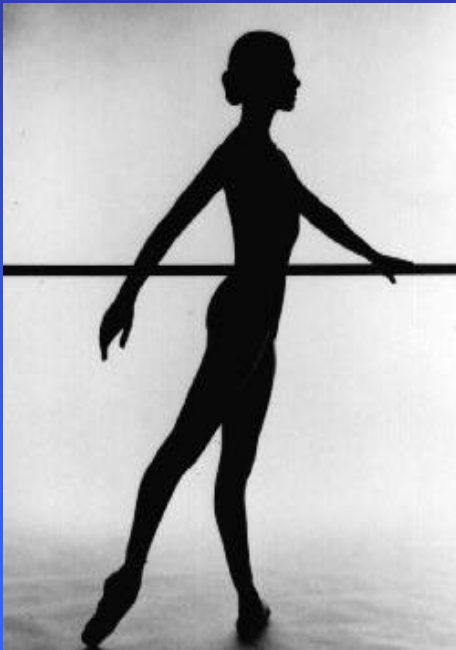
(splash, spray, spill)

Indirect Exposure

(residue, drift, off-gassing)

# Components of Exposure Receiver

**Dermal 2 m<sup>2</sup>**



**Inhalation 100 m<sup>2</sup>**

Ratio of Surface  
areas:

**50 to 1**



# PPE

## CA Regulatory Requirements

***Title 8 CCR Section 5192***

***and***

***Title 3 CCR Section 6738***

***Employer shall select and require  
the use of appropriate PPE.***



# PPE

## Hierarchy of Exposure Control

### *IH Standard*

- I. Engineering
- II. Administrative
- III. PPE

### *Agricultural*

- I. PPE
- II. Administrative
- III. Engineering

# PPE

## Selection of PPE

### Selection Criteria

*Label*

*MSDS*

*Manufacturer Guidelines*

*Unknowns*

# PPE

## Selection of PPE

### *MSDS/Label Review*

- ↖ *chemical/physical hazards*
  - ↖ *routes of exposure*
    - ↖ *reactivity data*
- ↖ *degradation/decomposition*
  - ↖ *compatibility*

# PPE

## Comparison of Protection

### Low Hazard

#### ***HAZMAT***

##### ***Level D***

**Coveralls**

**Boots/Shoes**

**Eye Protection**

**Hard Hat**

**Gloves\***

#### ***AGRICULTURAL***

##### ***Caution***

**Work Clothing**

**Boots/Shoes**

**Gloves\***

**Eye Protection\***

# PPE

## Comparison of Protection

### Moderate Hazard

#### ***HAZMAT***

##### ***Level C***

**CR Clothing**

**CR Boots/Shoes**

**Hard Hat**

**CR Gloves**

**FF Respirator**

#### ***AGRICULTURAL***

##### ***Warning***

**Work Clothing**

**Boots/Shoes**

**CR Gloves**

**Respirator**

**Sou'western\***

**Eye Protection\***

# PPE

## Comparison of Protection

### High Hazard

#### ***HAZMAT***

##### **Level B**

CR Clothing

CR Boots/Shoes

Hard Hat

CR Gloves

SCBA

#### ***AGRICULTURAL***

##### **Danger**

CR/Work Clothing

CR Boots/Shoes

CR Gloves

Respirator

Sou'western/BC

Eye Protection

SCBA for Fumigants

# PPE

## Comparison of Protection

### Extreme Hazard

***HAZMAT***

***Level A***

**Encapsulating Suit**

**CR Boots/Shoes**

**CR Gloves**

**SCBA**

***AGRICULTURAL***

***Fugedaboutit***







# Respiratory Protection



# Respiratory Protection

## Inhalation Hazards

### Oxygen Deficiency

Normal air=21% Deficient air<19.5%

*This is not a situation normally found in settings where pesticides are in use.* However, care must always be taken when entering confined spaces (vaults, silos, underground storage). Oxygen can be depleted chemically (“rusting”) or biologically (decomposition) or displaced (inert atmospheres).

# Respiratory Protection

## Inhalation Hazards

## Air Contamination

### Particulates

Solid or liquid material suspended in air and are referred to as dust, mists, fogs, or smokes. These are the most common physical states for pesticide applications.

They can vary in sizes and shapes, and can vary in toxicity from nuisance (pollen) to low (sulfur) to moderate (captan) to high (aldicarb).

# Respiratory Protection

## Inhalation Hazards

### Air Contamination

#### Gasses and Vapors

Materials that are in solution in air, including true gasses (chlorine, methyl bromide, sulfuryl fluoride), and vaporized materials (DDVP, 1,3-D, chloropicrin). These can be simple asphyxiants (inert atmospheres), irritants (ammonia) or systemic poisons (hydrogen cyanide, methyl bromide).

# Respiratory Protection

## End of 30 CFR 11

- As of July 10, 1998, all manufacturing of DFM non-PAPR respirators (TC-21C) and “pesticide” (TC-23C) respirators ceased.
- All TC-21C DFM and TC-23C *Pesticide* are still legal for use.

Oh,yeah, the labels...

# TC-84A Substitution Criteria

## TC-21C

**If label says “Wear a dust/mist respirator (TC-21C)”, the following are equivalent TC-84A types:**

**NO Oil in the formulation:** N, R, P (95,99,100)

**Oil in formulation, max. 8 hours of use:** R, P (95,99,100)

**Oil in formulation, no time restrictions:** P (95,99,100)

# Respiratory Protection

## OIL in respirator use

- **Oil** is defined as an organic long-chain hydrocarbon of high molecular weight, high boiling point, and low volatility. Agricultural examples include dormant oils, summer oils, volck oils, etc.
- Solvents (kerosenes, hexanes, mineral spirits, MEK etc.) are not considered oils for the purposes of respirator selection.



# TC-84A Substitution Criteria

## TC-23C

**If label says “Wear a pesticide respirator (either TC-23C cartridge or TC-14G canister )”, the following are equivalent TC-84A types:**

**N, R or P element (subject to oil/time restrictions previously stated) attached to an organic vapor (OV) removing element.**

# **Respiratory Protection Classes**

***TC-84A Particulate Filter (HF/FF/FFp)***

***TC-23C Chemical Cartridge (HF/FF)***

***TC-21C DFM (PAPR)***

***TC-14G Gas Masks***

***TC-19C Supplied Airline***

***TC-13F SCBA***

# Respiratory Protection

## IDLH

### **Immediately Dangerous to Life or Health**

Maximum environmental concentration of a contaminant for which one could escape within 30 minutes without developing escape-impairing symptoms or irreversible health effects.

Otherwise known as:

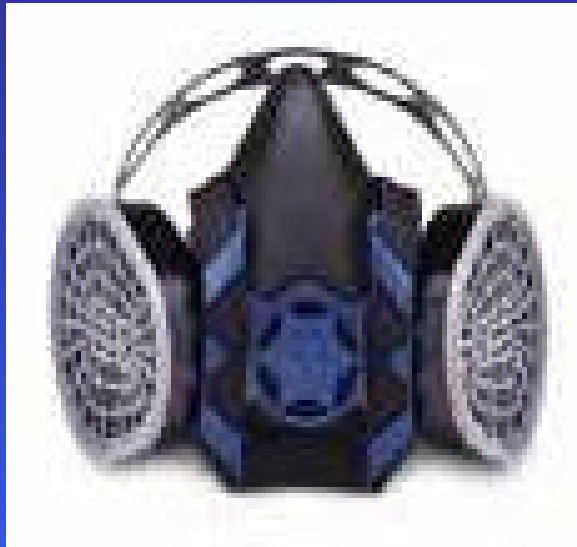
**I'll Die Laying Here**

# Respiratory Protection Classes

TC-  
84A



# Respiratory Protection Classes



TC-  
23C



# Respiratory Protection Classes



**Phosphine (Phostoxin®)  
Canisters Still in Use**

TC-

1



# Respiratory Protection Classes



IDLH OK

## TC-19C

Not normally used in  
agricultural settings



NO IDLH

# Respiratory Protection Classes



A must-have  
for fumigants.

TC-





# Respiratory Protection Classes



NOT-  
TC-  
13F

A must-have for post  
fumigation party.

# Respiratory Protection

When is respiratory protection required?

## Fumigant Labels

Respiratory protection used with fumigants (Methyl bromide, sulfuryl fluoride, carbon disulfide, etc.) is based on expected air levels of material and label directions. DPR regulations reference Cal/OSHA's Permissible Exposure Levels (PEL). Special DPR regulations cover fumigant use. SCBA use is **not** necessarily triggered by IDLH atmospheres.

# Respiratory Protection

## Cal/OSHA vs. DPR

DPR regulations apply to pesticide handlers and those potentially exposed to pesticides (e.g. harvesters). Cal/OSHA regulations apply to all other workers, including government employees. In 1998, changes were made in Cal/OSHA Respiratory Protection Regulations (5144), resulting in differences between DPR (6738) and Cal/OSHA requirements. DPR is presently amending 6738.

# Respiratory Protection

## When is respiratory protection required?

- Pesticide Labeling: Products that pose a definite inhalation hazard will have specific label language indicating “Wear a NIOSH approved \*\*\*\*\* respirator.
- If the label states “Avoid breathing vapor/dust/spray mist” can it be shown that this is possible. If not, a respirator may be required

# Respiratory Protection

## Fate of 6738 (h)

"It is said an Eastern monarch once charged his wise men to invent him a sentence to be ever in view, and which should be true and appropriate in all times and situations. They presented him the words: 'And this, too, shall pass away.' How much it expresses! How chastening in the hour of pride! How consoling in the depths of affliction!"

-Abraham Lincoln

# Respiratory Protection

DPR Regulation, 3 CCR 6738(h)

(h)(1) When required by label or regulation or to maintain exposure below applicable levels (Cal/OSHA, Title 8, Sec. 5155), employees must wear approved respiratory protective equipment.

# Respiratory Protection

DPR Regulation, 3 CCR 6738(h)

(h)(2) An employee must be provided with NIOSH approved equipment; the selection of this equipment must be based on labeling, or guidance from the American National Standards Institute (ANSI), Document Z88.2-1980.



# Fit Check





# Respiratory Protection

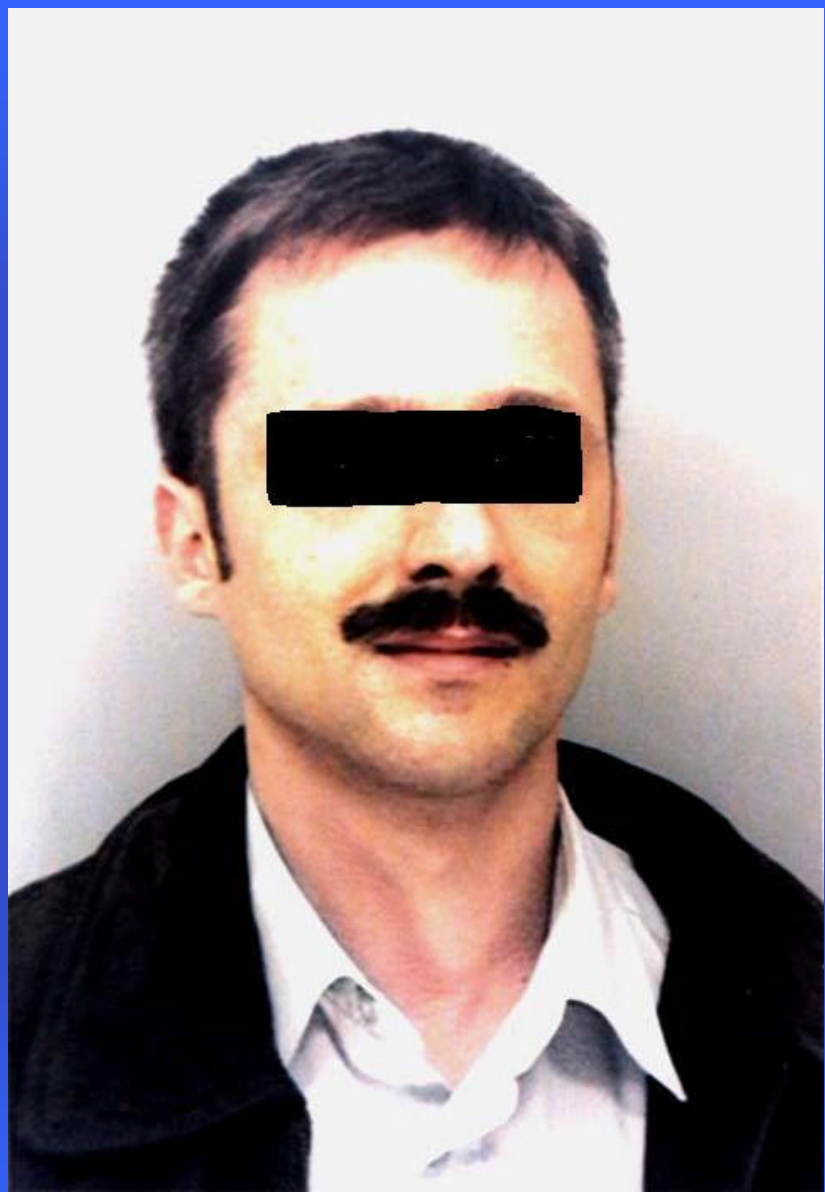
DPR Regulation, 3 CCR 6738(h)

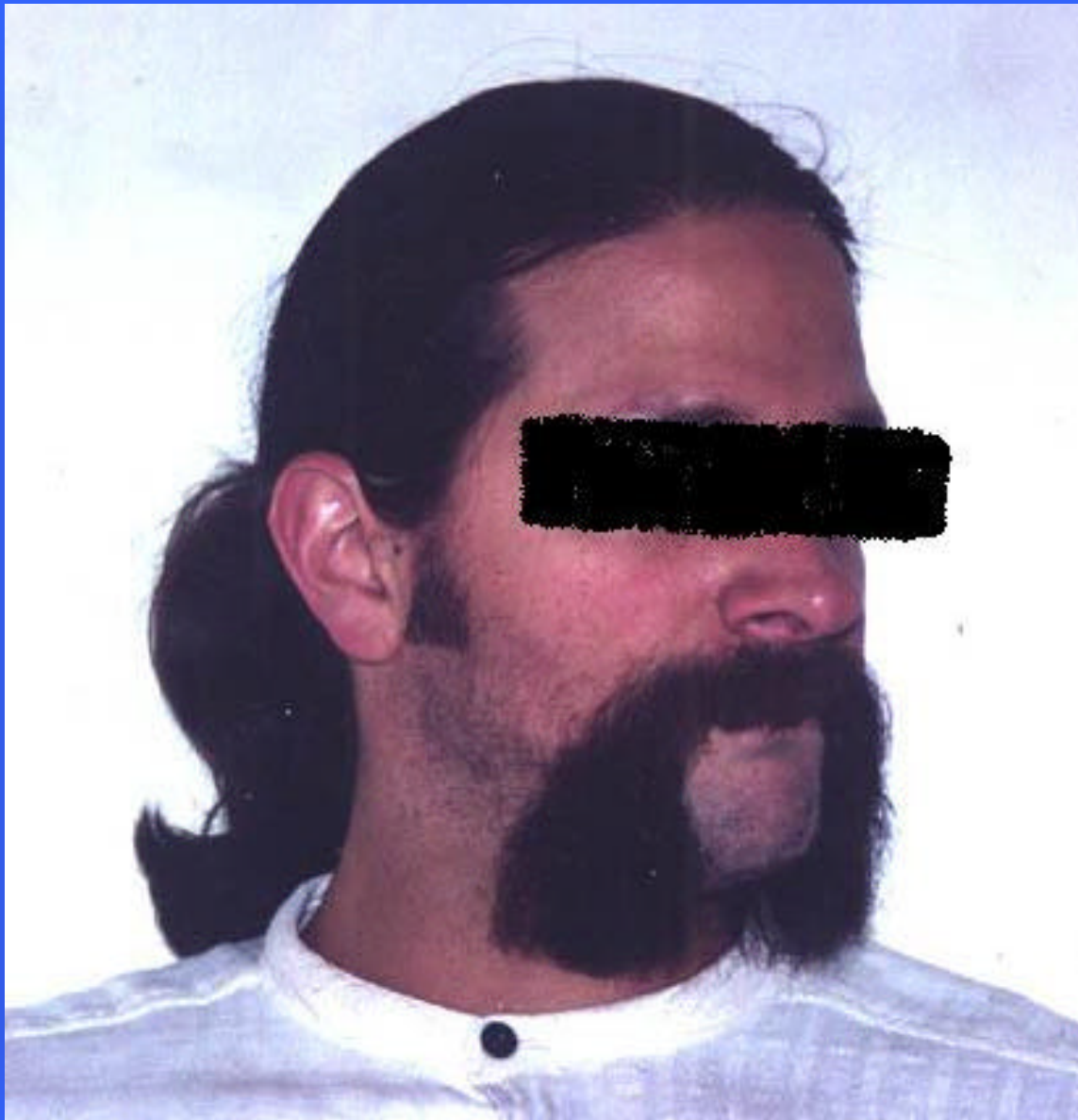
(h)(3) The employer must adopt **WRITTEN** operating procedures for selection, fitting, cleaning, sanitizing, inspecting, and maintaining respirators.

# Respiratory Protection

DPR Regulation, 3 CCR 6738(h)

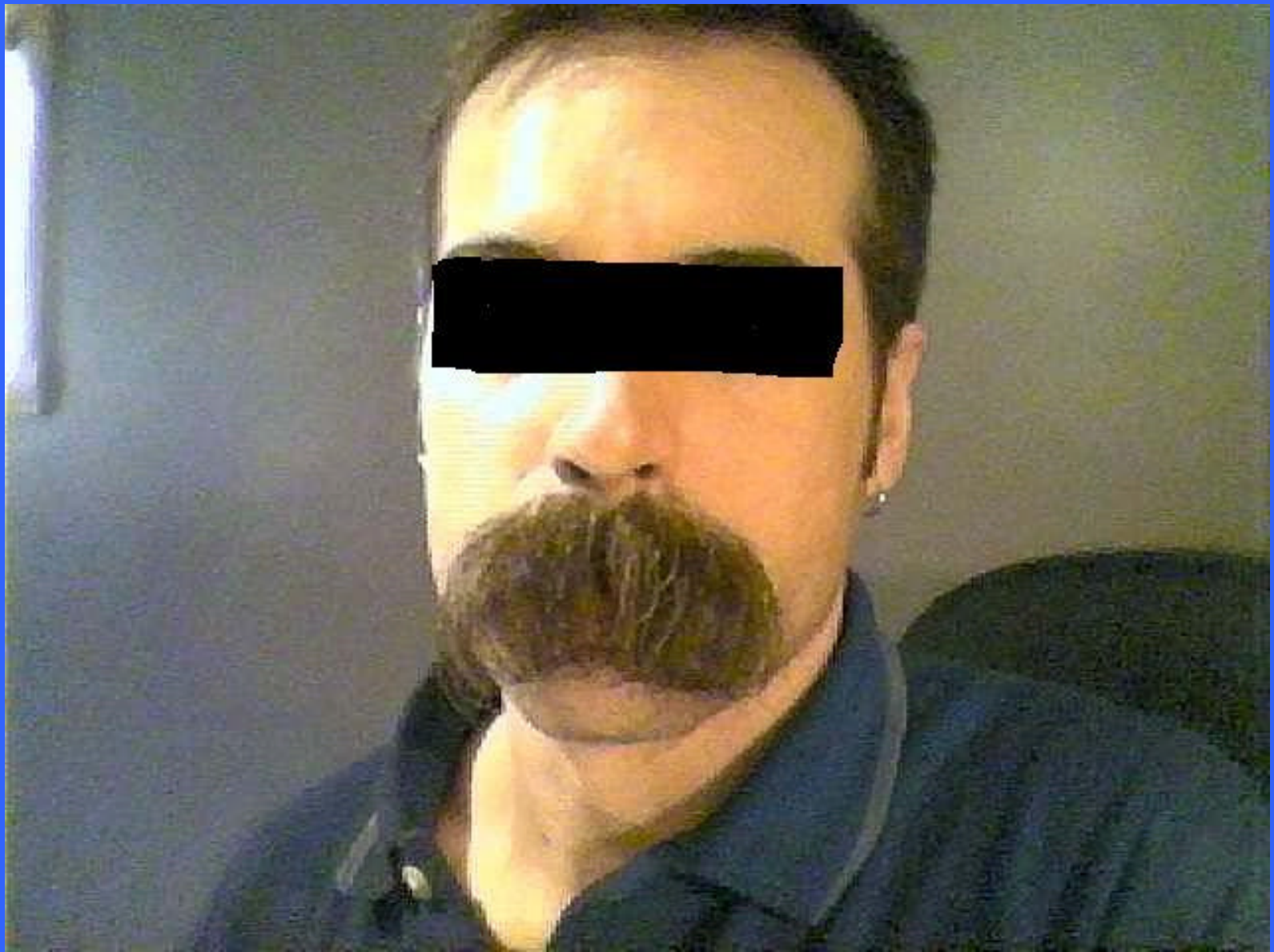
(h)(4) Facial hair that prevents a skin-to-facepiece seal is prohibited. Respirators which do not require a skin-to-facepiece seal are exempt from this requirement.

















# Respiratory Protection

DPR Regulation, 3 CCR 6738(h)

(h)(5) Emergency or stand-by respirators shall be inspected at least monthly (or more often if conditions warrant) and an inspection record shall be maintained with the respirator.

# Respiratory Protection

DPR Regulation, 3 CCR 6738(h)

(h)(6)(A) Employer shall inform the employee of medical conditions which could preclude the wearing of respiratory protective equipment. Each employee shall have on file a form substantially like the following:

# Respiratory Protection

## DPR Regulation, 3 CCR 6738(h)

To the best of my knowledge, I Have\_\_\_\_,  
Have no\_\_\_\_ medical conditions which would  
interfere with wearing a respirator while  
engaged in potential pesticide exposure  
situations. I understand that heart disease,  
high blood pressure, lung disease, or the  
presence of a perforated ear drum, among  
other conditions, require special medical  
evaluation by a physician before the safe use  
of a respirator can be determined.

Name\_\_\_\_\_

Date\_\_\_\_\_

# Respiratory Protection

DPR Regulation, 3 CCR 6738(h)

(h)(6)(B) If the employee notifies the employer of such a condition, a physician's report of evaluation of employee's fitness to wear a respirator shall be on file. A form substantially like the following is acceptable:

# Respiratory Protection

DPR Regulation, 3 CCR 6738(h)

On   Date  , I examined   Name  . At this time there **is/is no** medical contraindication to the employee named above wearing a respirator to allow working in potential pesticide exposure environments.

Comments: \_\_\_\_\_

\_\_\_\_\_

Physician: \_\_\_\_\_

Date: \_\_\_\_\_

# Respiratory Protection

DPR Regulation, 3 CCR 6738(h)

(h)(7) Compressed air used for SCBA units or air-line respirators must meet or exceed the requirements for Grade D breathing air as described in ANSI document Z86.1-1973 (Compressed Gas Association Commodity Specification G-7.1)

Uhhh.....no.



# Respiratory Protection

DPR Regulation, 3 CCR 6738(h)

(h)(8) Requirement/criteria for replacement of respirator air-purifying elements:

- According to label directions.
- Respirator manufacturer's recommendations.
- ***Absent any other instructions on service life, at the end of each day's work period.***
- At first indication, during use, of odor, taste or irritation. Wearer may exit area to adjust fit if misalignment is suspected.



# Personal Protective Equipment (PPE)

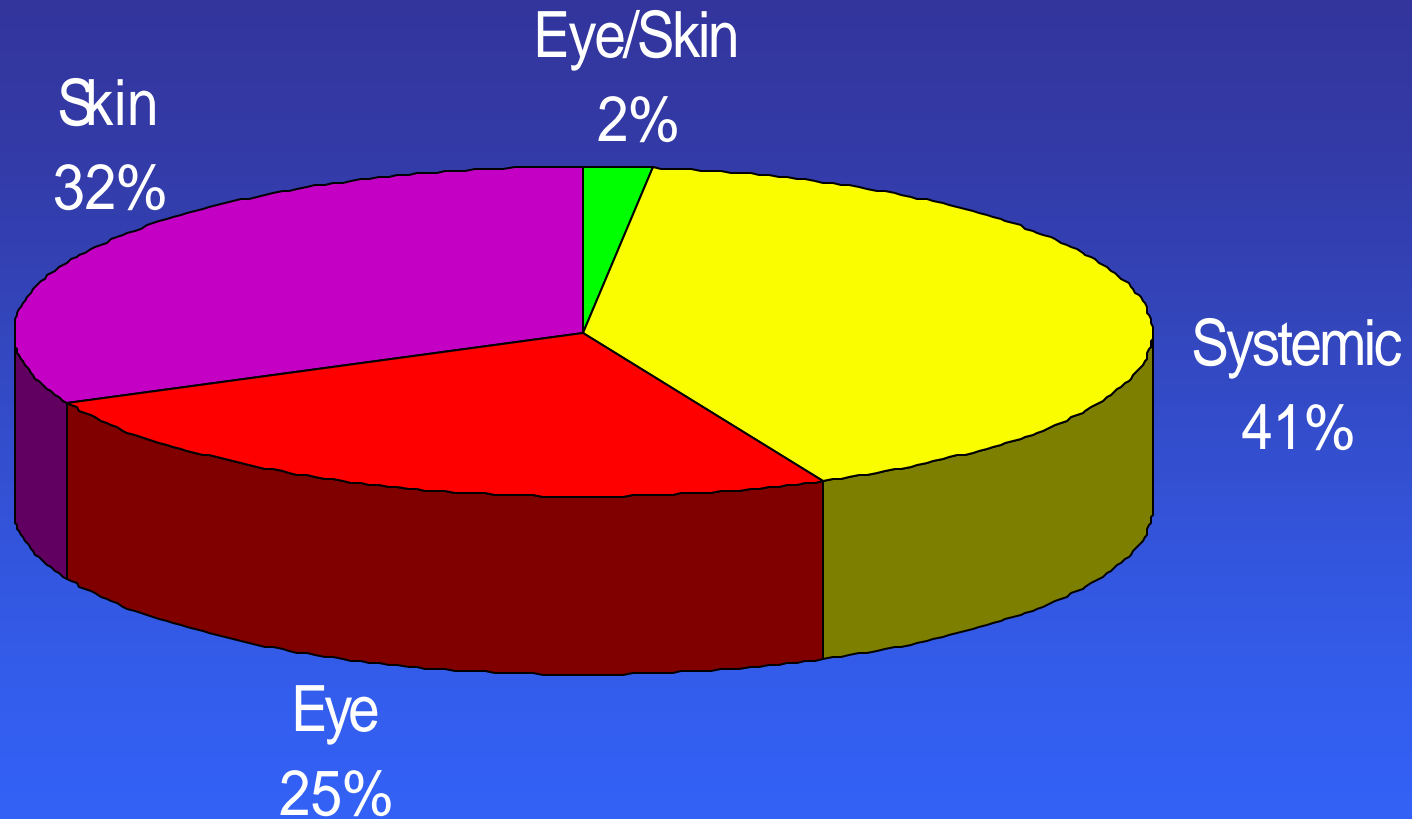
# PPE

## Function of PPE

- ❖ Body Coverage
- ❖ Eye Protection
- ❖ Extremities Protection

# PPE

## Pesticide Illness/Injury, By Type



➤ **96-99 PISP Data**  
**(WH&S)** No NonOcc/Drift/StrucRes

# PPE

## Function of PPE

### ❖ Body Coverage

- ⌚ Workclothes\* (long pants\*\*, long sleeved shirt\*\*)
- ⌚ Coveralls (cotton/synthetic/chemical resistant)
- ⌚ Aprons (chemical resistant)
- ⌚ Rainsuits
- ⌚ Full Body Encapsulation

\*not PPE

\*\*

# Workclothing



# Not Workclothing



Category I/II



Category III



# PPE

## Function of PPE

### ❖ ***Extremities***

#### ❖ Gloves (Hand/Arm Protection)

##### ⊠ Chemical Resistant (organic solvent)

⌘ Neoprene, Nitrile, Rubber, Viton, Silver Shield

##### ⊠ Chemical Resistant (aqueous solvent)

⌘ PVC

##### ⊠ Special Case

⌘ Leather, Fumigants

# Chemical Resistant





# PPE

## *Glove Category Selection Key Based on USEPA Label Codes*

<b>Label Code</b>	<b>Chemical Class</b>	<b>Recommended By CDPR</b>
<b>A</b>	<b><i>Water and Dry materials</i></b>	<b><i>1,2,3,4,5,6,7,8</i></b>
<b>B</b>	<b><i>Ketones</i></b>	<b><i>1,2</i></b>
<b>C</b>	<b><i>Alcohols</i></b>	<b><i>1,2,3,4,7,8,</i></b>
<b>D</b>	<b><i>Acetates</i></b>	<b><i>1,2</i></b>
<b>E</b>	<b><i>Aliphatic Hydrocarbons</i></b>	<b><i>1,3,4,8</i></b>
<b>F</b>	<b><i>Aromatic Hydrocarbons</i></b>	<b><i>1,2,3,8</i></b>
<b>G</b>	<b><i>Benzenes</i></b>	<b><i>1,8</i></b>
<b>H</b>	<b><i>Halo-hydrocarbons</i></b>	<b><i>1,8</i></b>

***1:Laminate 2:Butyl 3:Nitrile 4:Neoprene 5:Natural  
6:Polyethylene 7:PVC 8:Viton***

***All but Laminate and Polyethylene must be 14 mils or thicker***

# PPE

## Function of PPE

### ❖ *Extremities*

#### ⌚ Foot Protection

- ⊕ Boots (chemical resistant)
- ⊕ Shoes (chemical resistant)
- ⊕ Shoes (non-chemical resistant)

# Irrigator Boot



# Non Chemical Resistant Boot



# PPE

## Function of PPE

### ❖ *Extremities*

Ω Head Protection

✧ *Bump Caps/Hard Hats*

✧ *Sou'western*

✧ *Hoods*

# PPE

## Function of PPE



Sou'western



RASH  
MAKER



BumpCap

# PPE

## Function of PPE

### *Eye/Face*

∞ Face Shield

∞ Safety Glasses (temple and brow protection)

∞ Goggles

∞ Full Face Respirator

∞ Sunglasses normally NOT acceptable



**Not exactly what we had in  
mind.**



This is more like it...



# PPE Equipment

## DPR Regulation, 3 CCR 6738(a)

**EMPLOYERS** shall provide all necessary PPE, keeping it clean and in good repair. Equipment must be inspected daily.

Heavily contaminated PPE shall be replaced.

Leather gloves used with phosphides shall be aerated for a minimum of 12 hours for cleaning.

Store clean PPE in a specifically designated, pesticide-free area.

# PPE Equipment

## DPR Regulation, 3 CCR 6738(a)

Prevent hyperthermia as needed.

Make sure PPE is used properly.

Store and wash used PPE separate from other laundry. Dry PPE properly.

Never allow contaminated PPE to be taken home by workers.

Make sure the personnel maintaining PPE know what they're doing.

# PPE Equipment

## DPR Regulation, 3 CCR 6738 (b)

Eye protection shall be provided and worn when required. There are exceptions.

Protective eyewear includes:

1. Goggles
2. Face-shield
3. Full-face respirator
4. Safety glasses with temple/brow protection
5. Visors (for aircraft pilots ONLY)

# PPE Equipment

## DPR Regulation, 3 CCR 6738(c)

Gloves shall be provided when required by the pesticide label or when mix/loading, working on contaminated application equipment or using hand-application equipment. There are exceptions.

If no specific glove type is mentioned on the label, use chemical resistant gloves. Absorbent glove liners are prohibited.

Leather over chemical resistant liners may be used in certain situations.

# PPE Equipment

## DPR Regulation, 3 CCR 6738(d)

Chemical resistant footwear shall be provided when required by the pesticide label.

Protective footwear includes:

1. Chemical resistant shoes
2. Chemical resistant boots
3. Chemical resistant shoe/boot coverings

*Aircraft pilots need not wear chemical resistant footwear*

# PPE Equipment

## DPR Regulation, 3 CCR 6738(e)(f)

When required, head protection shall be worn. This includes a chemical resistant hood or a chemical resistant, wide brim hat. Aircraft pilots may use helmets.

When required, chemical resistant aprons shall minimally cover from mid-chest to knees.

# PPE Equipment

## DPR Regulation, 3 CCR 6738(g)

When required by label or regulation, a chemical suit must be used and must cover torso, head, arms and legs. These include rainsuits, chemical resistant coveralls (liquid impervious) and encapsulating suits.

The 80° daylight/85° night standard applies to full-body protective suits.

# PPE Equipment

## DPR Regulation, 3 CCR 6738(i)

### **Exceptions:**

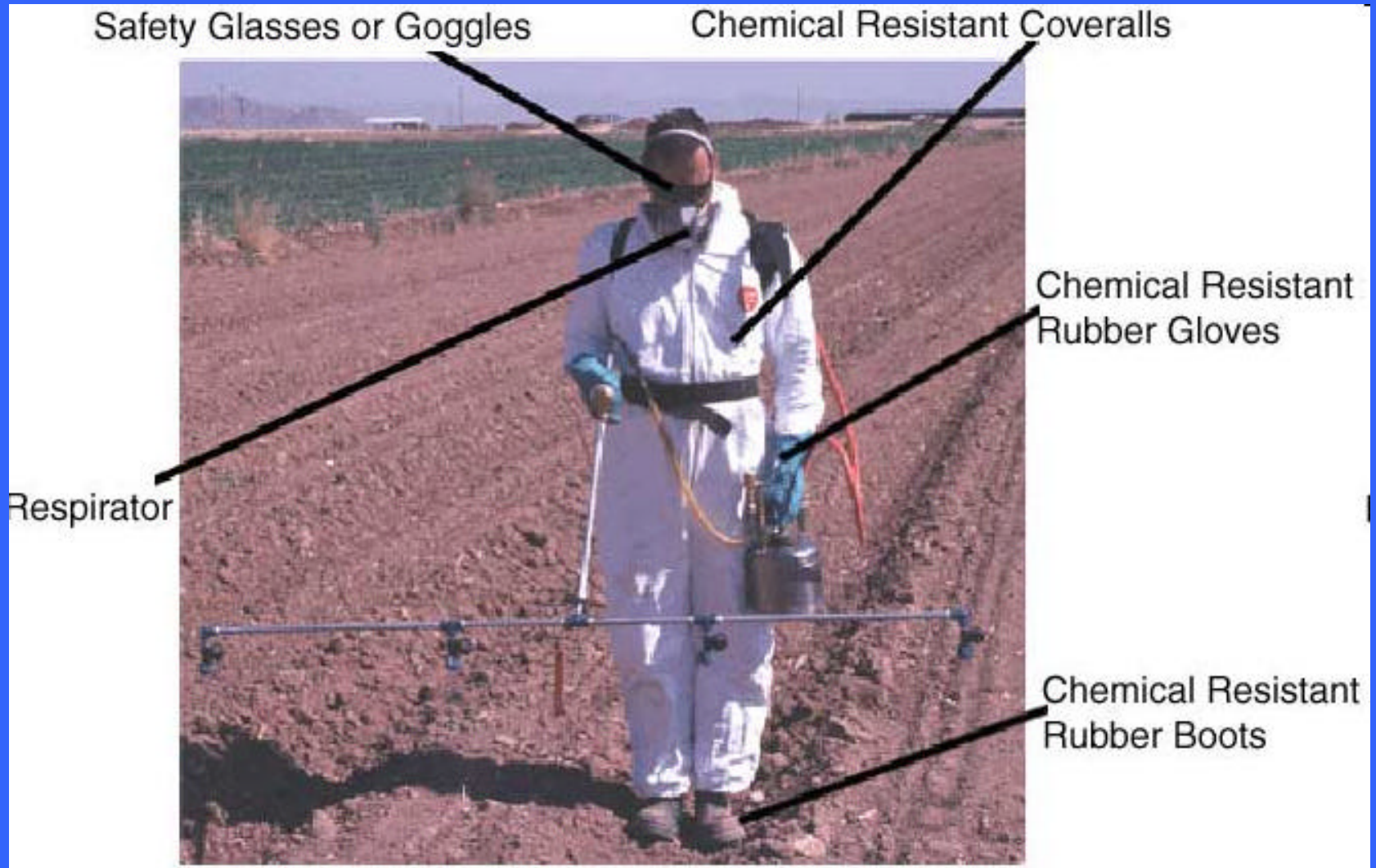
Closed Systems/Mechanical transfer

Water soluble packets

Enclosed cabs

No gloves required for pilots during flight





Forgot the tractor.

# Further Information

Cal/EPA

Department of Pesticide Regulation

Worker Health and Safety Branch

Industrial Hygiene Program

916-445-4222

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# B'bye

